US Army
Corps of Engineers

Web Mapping Technology Program

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Discussion Points

- 21st Century Environment
- Program
- Architecture
- Technology Integration
- Demos and Pilots

21st Century Environment

US Army faces...

- Adversaries with both high- and low-tech capabilities, employing asymmetric strategies, some with WMD
- Wider range of interoperability requirements with partners (multinational, interagency, and non-state)
- Increased variety of threats and crisis frequency
- Requirements to integrate resources and capabilities found outside DOD
- Less planning and execution time

From Joint Vision 2010

21st Century Environment

- New challenges added -
  - Homeland Defense
  - Coalition Warfare
  - Disaster Response
- Will require Army coordination with other communities
- Unprecendented geospatial knowledge requirements

The Problem...

Need better ways to access and exploit geospatial information from diverse information communities and disseminate information to Army users.

Interoperable Web Mapping Technology Can Help

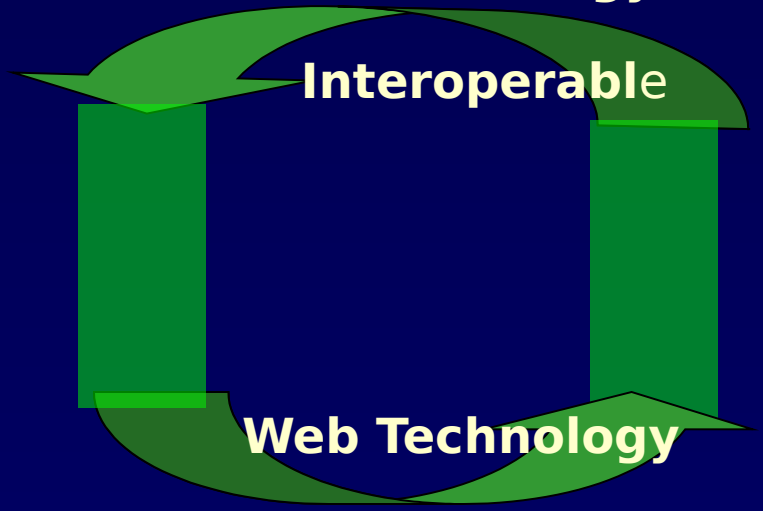
A key information resource for future mission areas will be geospatial information that is on-line and accessible using standards-based *web mapping technology*.

Web Mapping Technology Program

Objective:

Develop and evaluate *next-generation* interoperable Web-based mapping technology ~~solutions~~.

- **Fuse GI from multiple servers simultaneously**
- **Distributed applications to exploit GI**
- **Standards for interoperability**
- **Dual-Use technology**

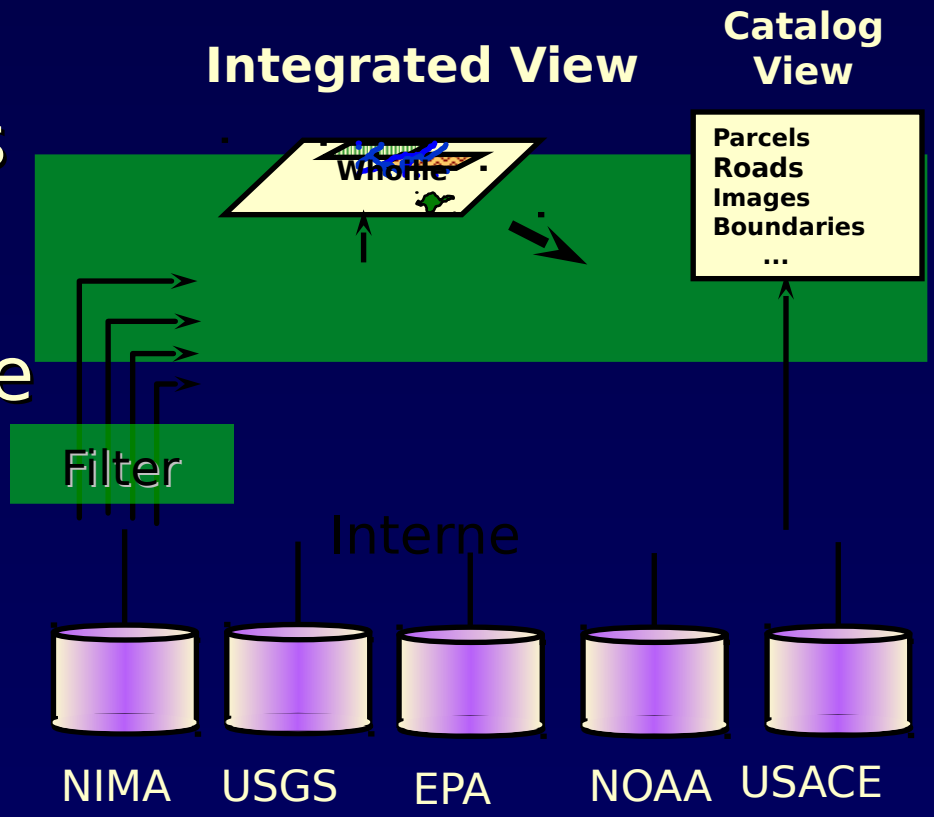


Geospatial Information Sources

oorative Development Opportunity - Industry, Government, Acad

Web Mapping Technology - Requirements

- Web servers interact with map viewer client capable of:
  - Discovery and access from multiple servers
  - Display multiple layers of GI within same map display
  - Query and update
  - Interface for visualization, terrain analysis, environmental, etc.
  - Other (pos/nav)
- Data to include raster, vector, matrix, and other



From Initial 1998 Requirements Documents - S

WMT Map Server/Geospatial Information Model

Levels and Views:

Specialized Views

City (10x10 - 5x5 km)

Metro Region (100x100 k

County (250x250 km)

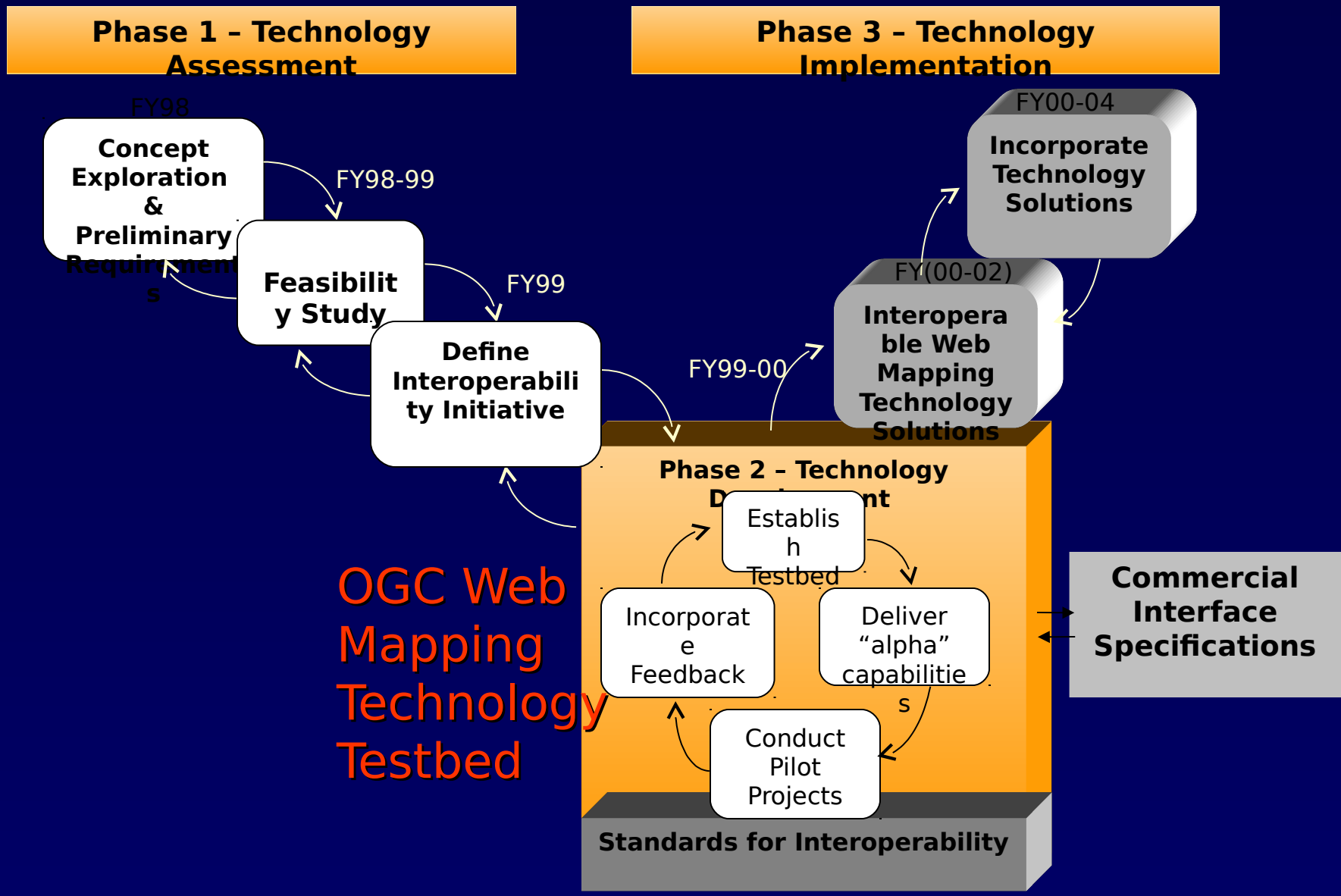
State (500x500 km)

Regional (Gulf - 1500x150

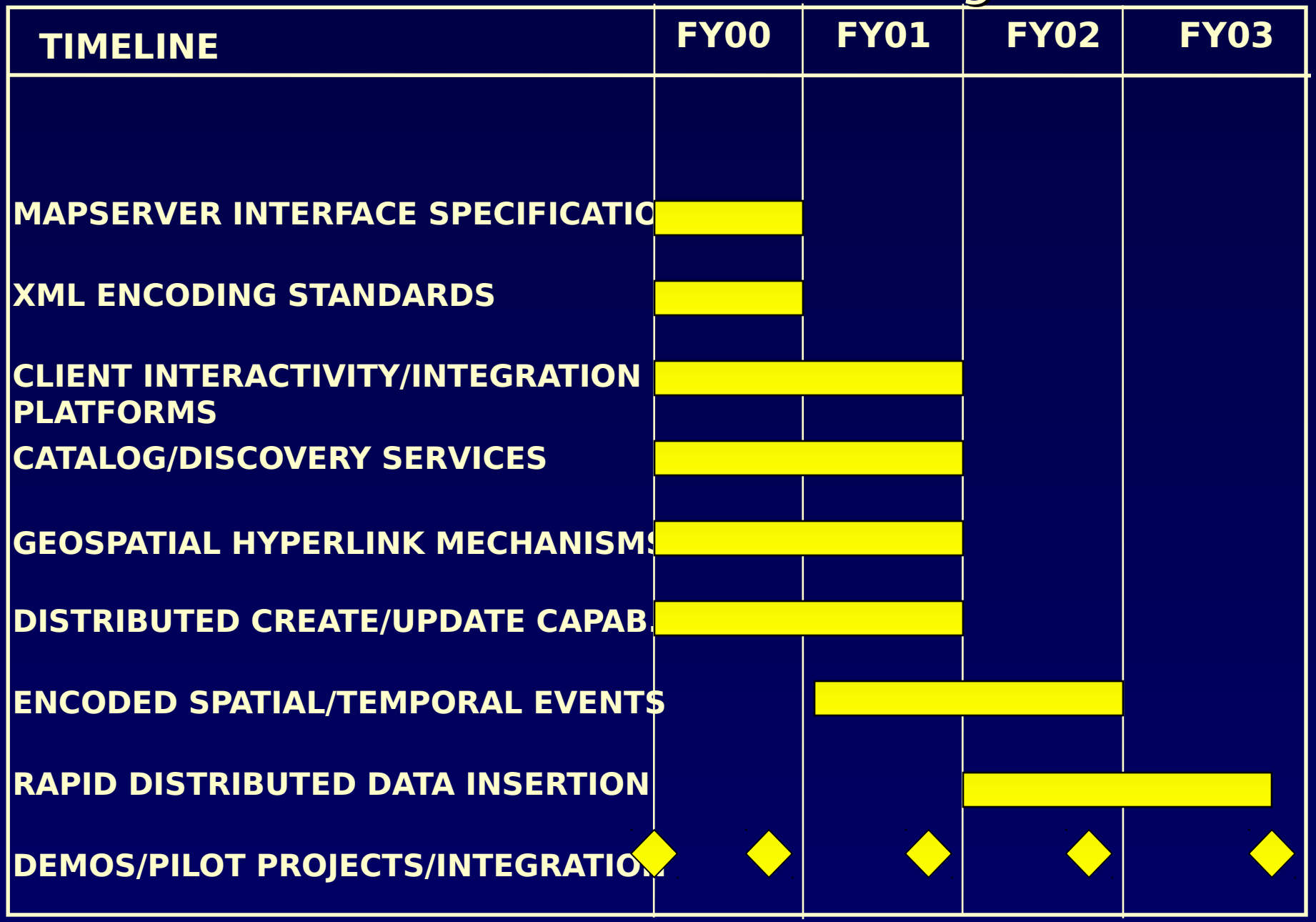
TransNational/Global

- **Commercial map servers extended, understand new specifications.**
- **Organizations serve and maintain web map views of geospatial information they care about.**

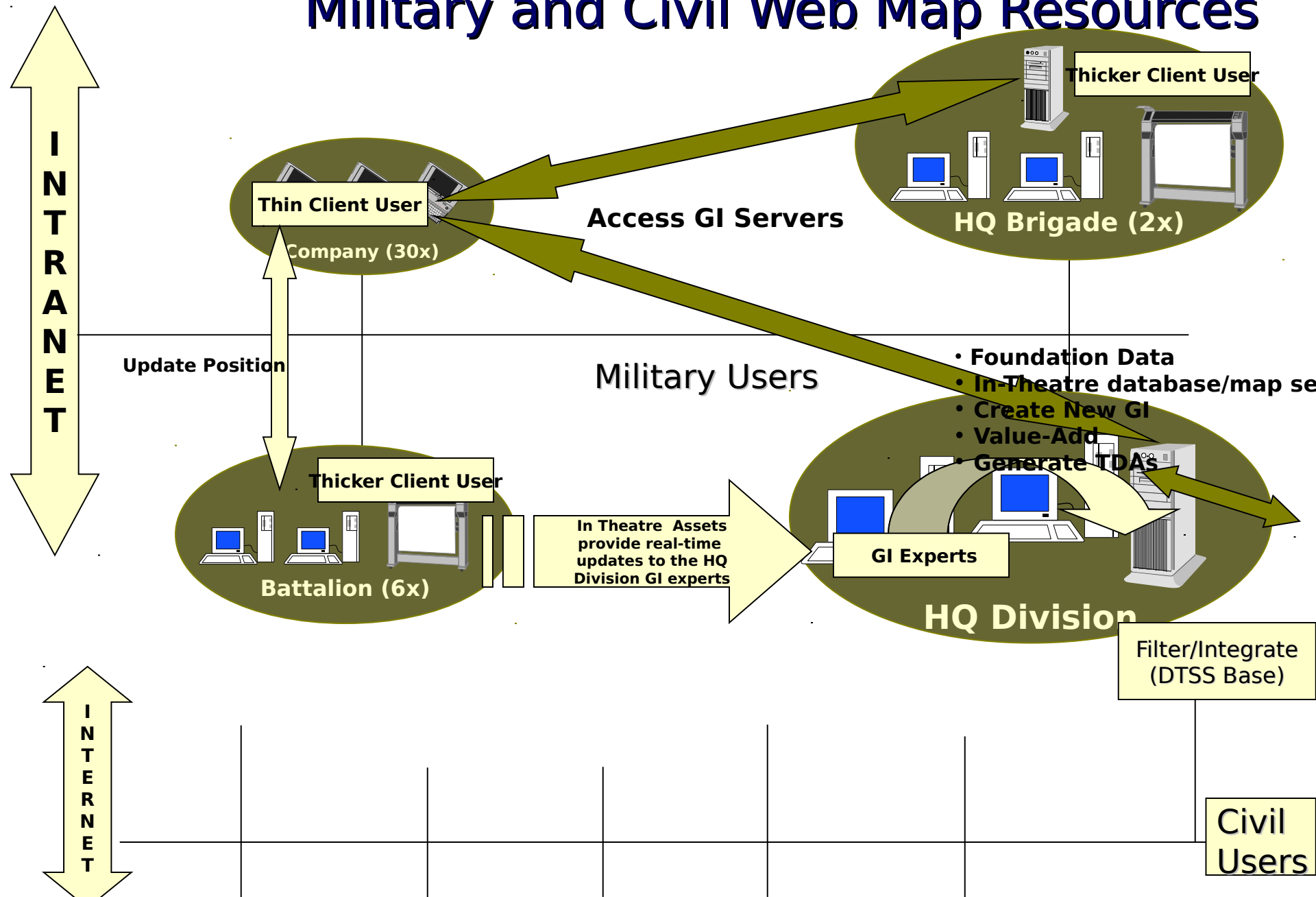
OGC Web Mapping Testbed and Technology Development



Planned Work Efforts and Program Schedule



A System Model - Military and Civil Web Map Resources



Web Mapping Technology Program - FY00 Priority Work Efforts

- **MAPSERVER INTERFACE SPECIFICATION**
  - Develop specifications for communications between viewer client, map server, integration and discovery tools that enable interoperable web mapping.
  - Incorporate specifications for picture, graphic elements, and data, query functionality, multiple spatial reference systems, and access to applications servers to create web map graphic overlays.

- **CLIENT INTERACTIVITY/INTEGRATION PLATFORMS**
  - Extend existing commercial clients, develop new clients, client tools, and cascading map servers capable of accessing and exploiting multiple map servers simultaneously using standard specifications regardless of format.
  - Develop clients capable of exploiting standard XML-

Web Mapping Technology Program - FY00 Priority Work Efforts

- **CATALOG/DISCOVERY SERVICES**
  - Develop specifications and tools to search, locate, and access multiple standards-based, web-distributed, on-line geospatial resources.
  - Incorporate capability to access preset applications.

- **XML ENCODING STANDARDS/HYPERLINK MECHANISMS**
  - Develop standard, interoperable methods to encode and transport geospatial information across the Web
  - Develop standard, interoperable methods to link Web-distributed geospatial resources by information use and geospatial content.

Web Mapping Technology Work Unit - FY00 Priority Work Efforts

- **DISTRIBUTED CREATE/UPDATE CAPABABILITY**
  – Within the framework of interoperable web mapping, develop capability to perform spatial transactions and manipulation using web-distributed tools to produce custom information products that serve specific mission needs.
  – Include capability for remote spatial transactions (create, insert, modify, update, delete features) and manipulation of feature data using a web mapping client.
  – Incorporate capability to download, store, integrate, and create new features from standard encoded geospatial information using a web mapping client (NEED DATA!)

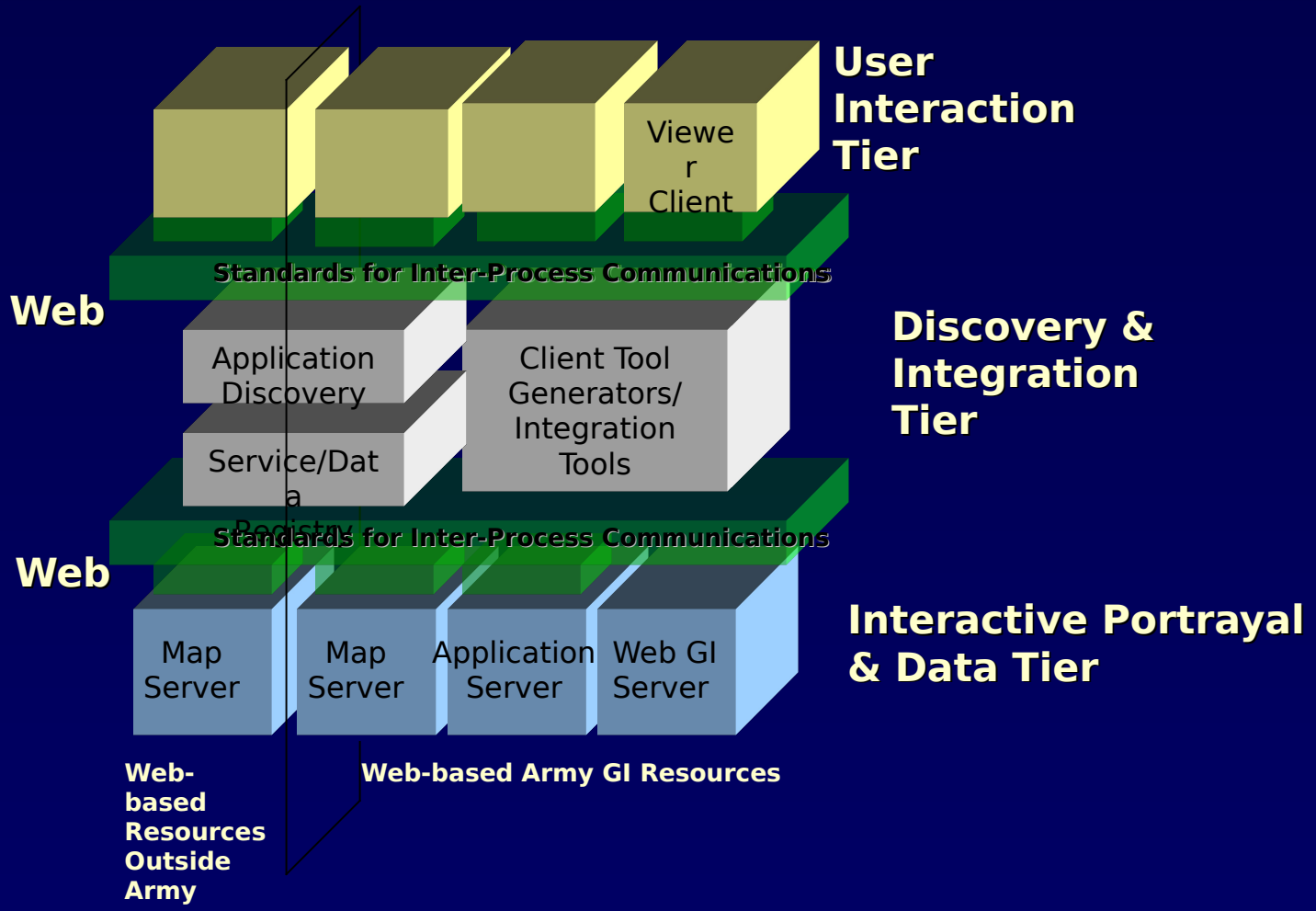
- **PILOT PROJECTS/INTEGRATION**

Web Mapping Technology Work Unit - Outyear Work Efforts

- **ENCODED SPATIAL TEMPORAL EVENTS**
  – Extend standard encoding formats for geospatial information to model, transport, and analyze dynamic spatial-temporal structures (events).
  – Provide capability to distinguish points in time as well as durations and attribute types to be used in conjunction with standards-based spatial structures.

- **RAPID DISTRIBUTED DATA INSERTION**
  – Within the framework of interoperable web mapping, improve capability to query multiple databases across disparate servers, dynamically web-optimize and exploit multiple distributed remote information sources that do not have a web map server.
  – Incorporate positional tracking and control.

Some components in the architecture



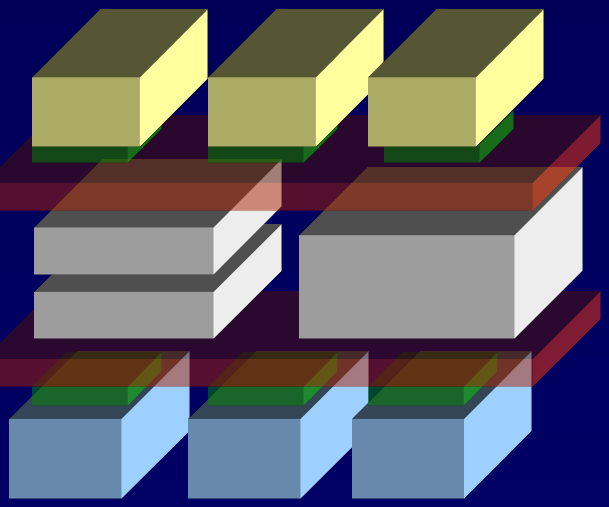
Inter-Process Communications - MapServer Interface Specifications

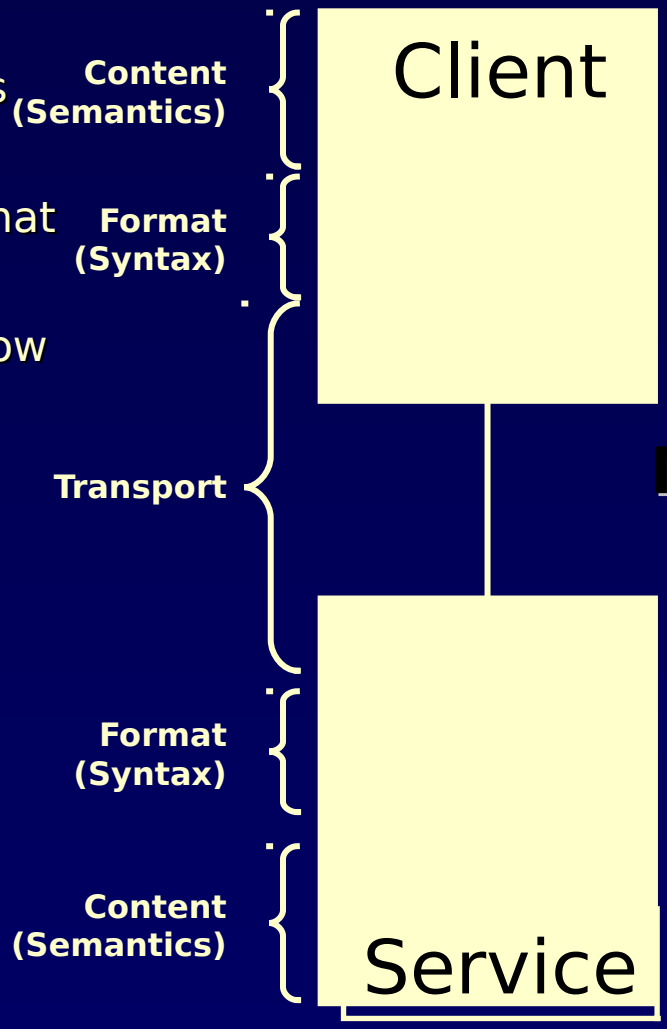
GetMap - Specifies communication protocols to merge many web map views into one view.

GetCapabilities - Explains what a map server can do

GetFeatureInfo - Specifies how to ask for more information about web map features.

More to Come!



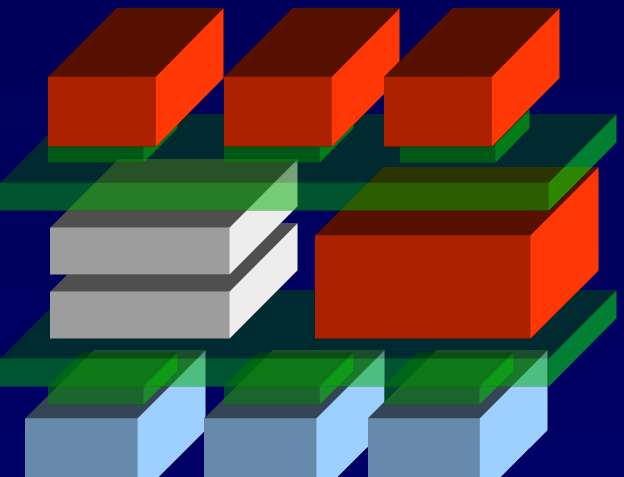


MapServer Interfa

User Interaction - Thin Clients

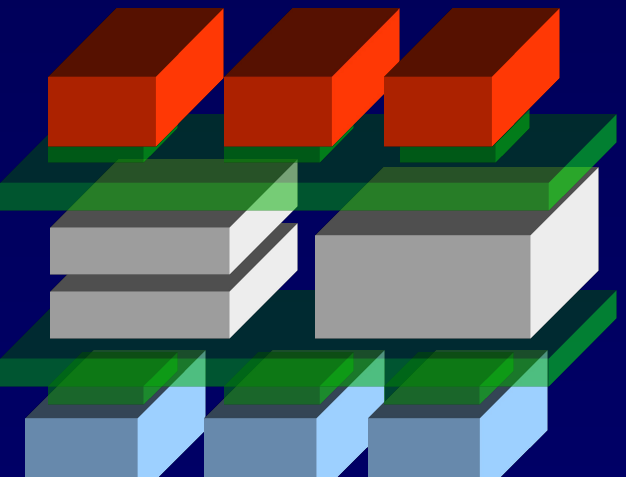
- HTML Viewer Clients to access multiple map servers simultaneously.
- NIMA data, coalition partner data, civil data
- Interface to discovery services
- Navigation, legend, and layer control functions
- Feature query capability
- Preset applications to aid navigation

Three map servers accessed simultaneously using WMT MapServer Interface specifications and Netscape browser.



User Interaction - Thicker Clients

- Enhanced Clients (not HTML) access multiple map servers simultaneously
- Navigation, legend, and layer control functions
- Feature query capability
- Use remote views and local standards-based data.
- Create and update - field user updates over the web
- Extend symbolization to allow flexible user-specific symbolization
- Support context-based views
- Extend interface to application map servers
- Discovery interface

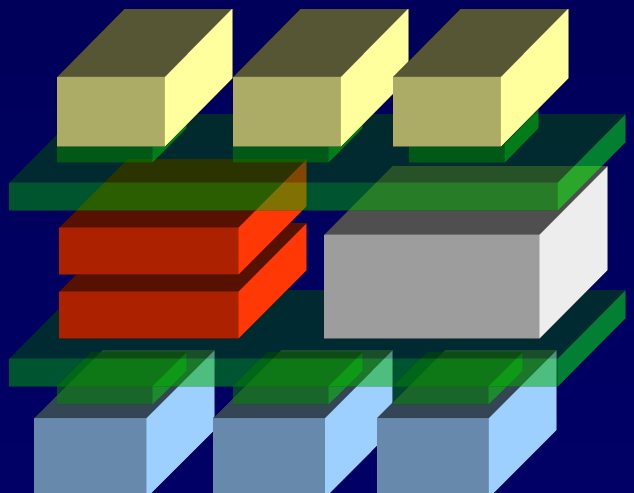


Three map servers accessed simultaneously using WMT MapServer Interface specifications.

Discovery Services

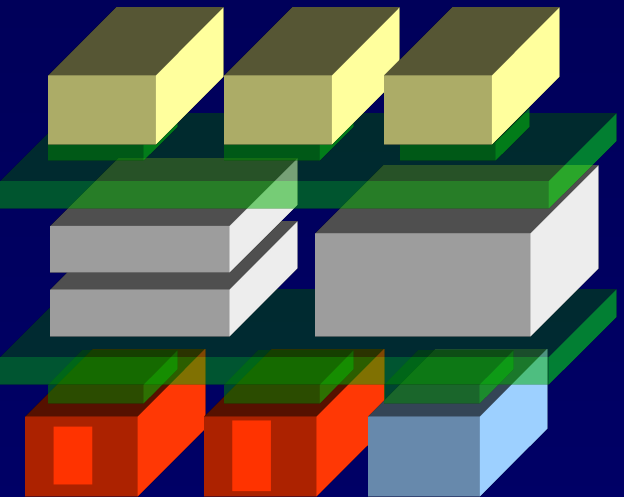
Intuitive interfaces and tools to search, locate, and access multiple web-based, on-line geospatial resources and collateral terrain-related information.

Preset applications



Interactive Portrayal - Commercial Web Map Servers

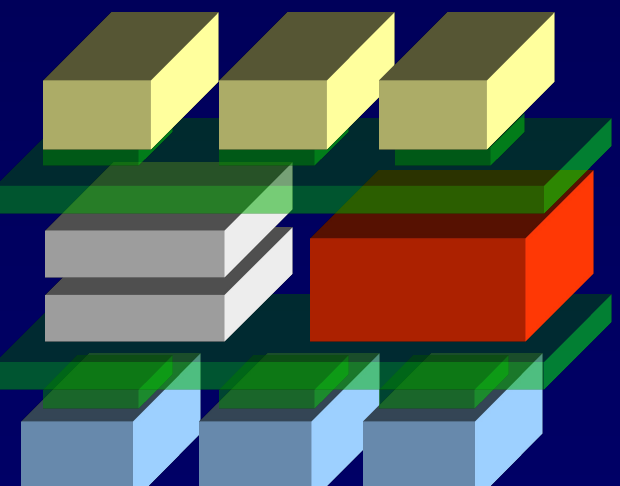
- Commercial web map servers extended for new WMT protocols.
- Web-accessible spatial data warehouses provide vector and imagery foundation
- Application servers

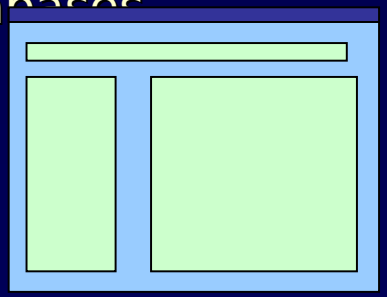


Integration Tools

Enable access to multiple web-based, on-line geospatial resources and collateral terrain-related information.

Integrate views into theater geospatial databases

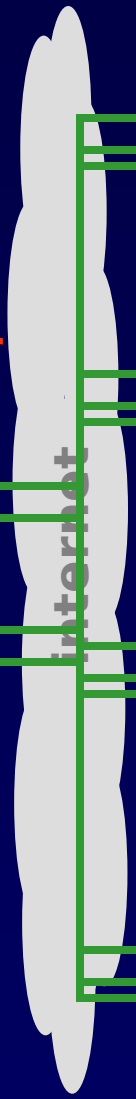




Cascading Map Server

Capabilities Integrator

Map Integrator



Map Server — GIF, WGS 84

Map Server — PNG, AL St Pln, PNG, AL St Pln

Map Server — GIF, NAD 83

Map Server — JPEG, WGS 84

Essential in any architecture

Problem

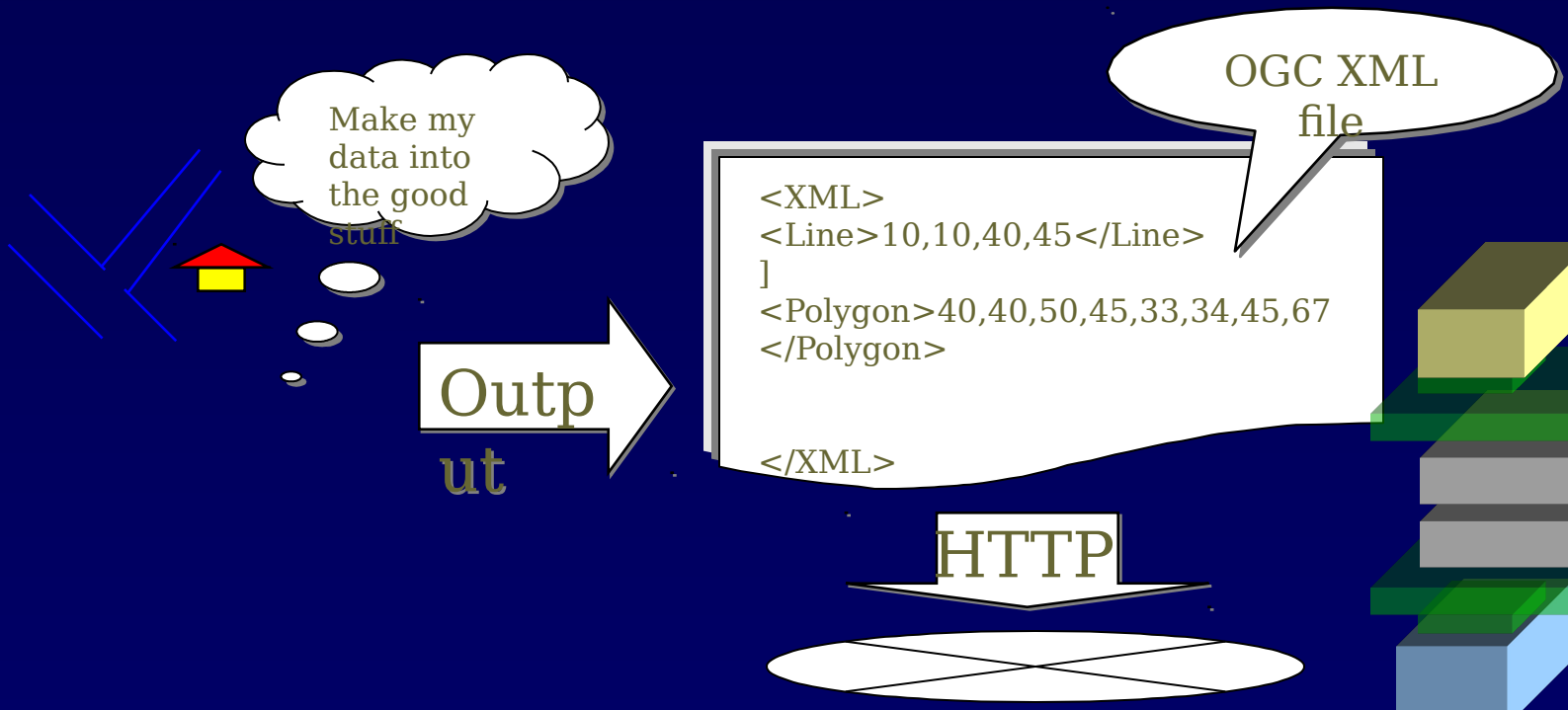
- No standard, interoperable method to encode and transport geospatial information across the Web.
- No standard way to link Web-distributed geospatial resources by information use and geospatial content.

The “Trick”

- *Standard protocols for encoding GI and Web mapping messages designed for the Web.*
- Use XML technology to do this.

So Basically…

- eXtensible Markup Language (XML) for standard way to publish and access GI in Web environment.
- XML tools for easy data update and integration

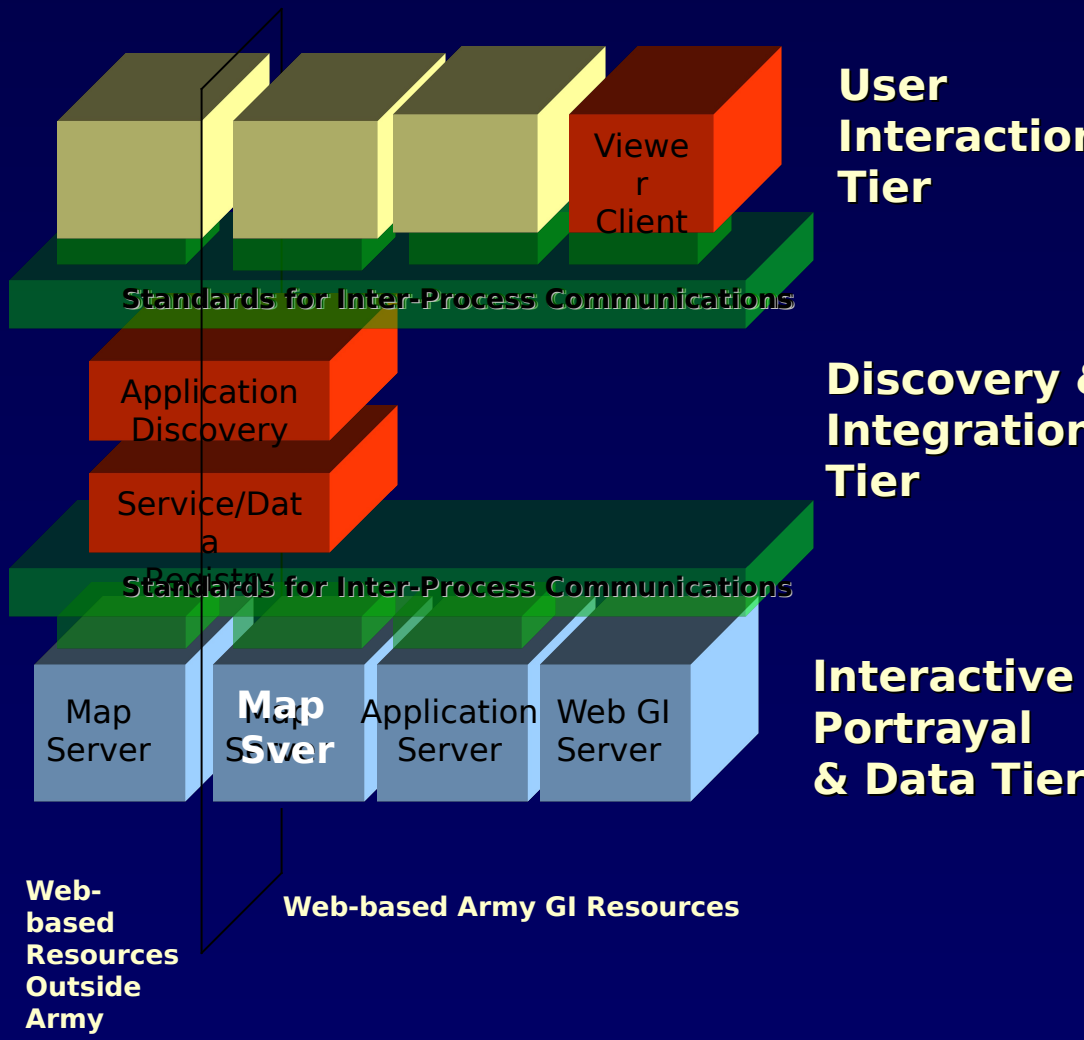


Links

- XLink and Xpointer concept.
- Linking feature types to source data
  - e.g. click on feature and view information about that feature.
  - Experiments will focus on these links being defined external to the two datasets and to the map on which the user clicks.
- Link to ranges
  - Link from some source (this can be a text element such as "evacuation route") to a feature range - such as all elements of a road starting from some point.
- With XML enabled maps we can also dynamically link geographic entities with external documents, data records and even other geographic information.

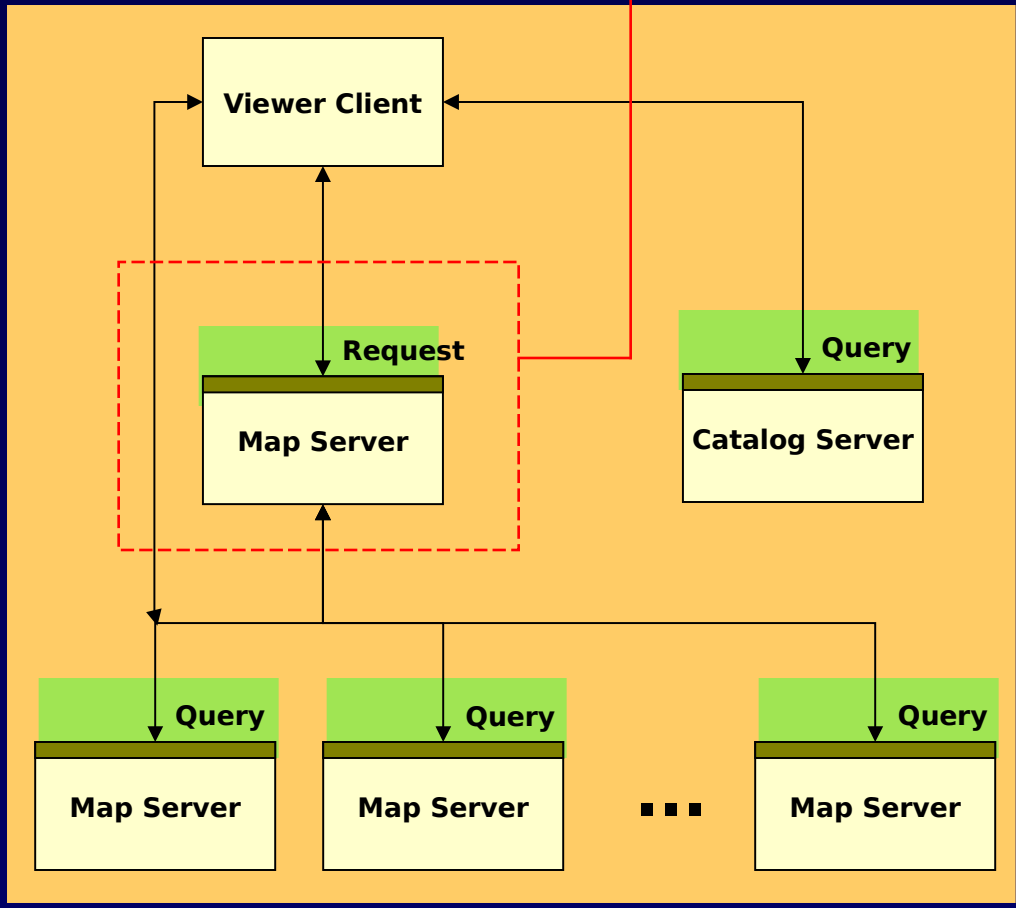
Web Mapping Technology Program- Integration Cell

- Based on Web infrastructure.
- Focused on geospatial and georeferenced problems/applications.
- Testbed as ‘model’ - test and evaluation environment.
- Development Team primarily focused on Discovery, Integration, some User tools in FY00.



Web Mapping Technology Program- Integration Cell Activities

- Systems management (software documentation, reuse, deployment)
- Determine connection and server management options (damn firewalls again)
- Intranet integration tests
- Reusable, interoperable web mapping components to
  - discover, distribute and access web GI & georeferenced information
  - enhance existing applications
  - custom client applications
- Enterprise training program for interoperable web mapping technology



WMT Demonstrations and Pilots (proposed)

Technology Demonstrations (TIE/IFD)

Core Demonstration -

- Scenario-based demonstrations support specification development process and promote fast-track development of interoperable technologies.
- WMT responsible for all development and integration activities.
- May be partially distributed.

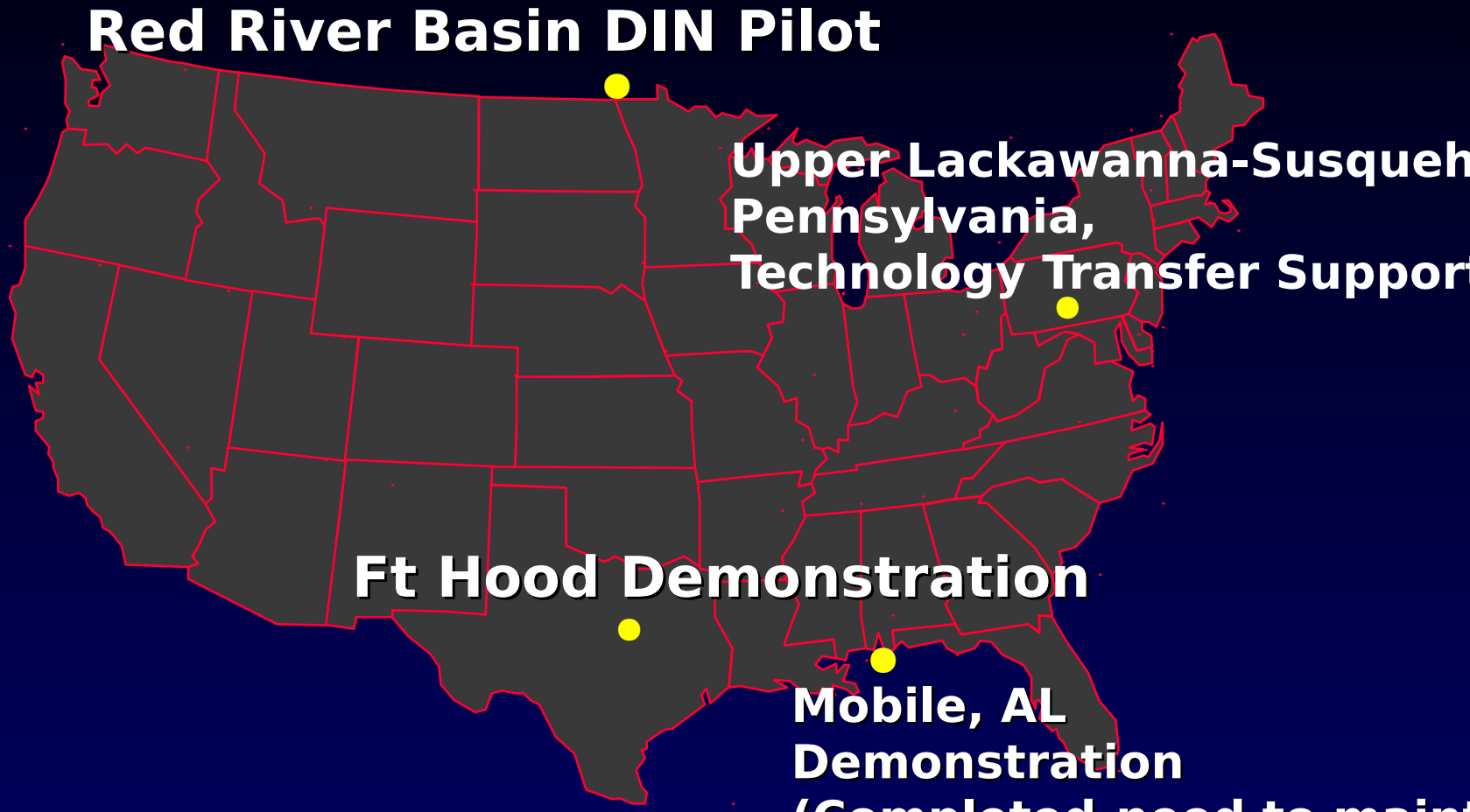
Pilot Projects -

- Demonstrations support real-world applications.

Technology Transfer Projects-

- Integrate interoperable geoprocessing with Internet and database technologies to support customers' distributed real-world applications.
- SCOTS software solutions available to customers.
- SCOTS vendors work directly with customers during deployment and integration

WMT Demonstrations, Potential Pilots, Technology Transfer Support - US Army Corps of Engineers



Web Mapping Testbed

Potential Pilot Projects

- **Red River Basin Disaster Information Network: Phase II** - St Paul District - (Contractors: SAIC, Autometrics, others) - Web mapping to link US & Canadian interests responsible for floodplain management. Integrate with regional DIN under construction to promote collaborative activities among diverse user/provider community.

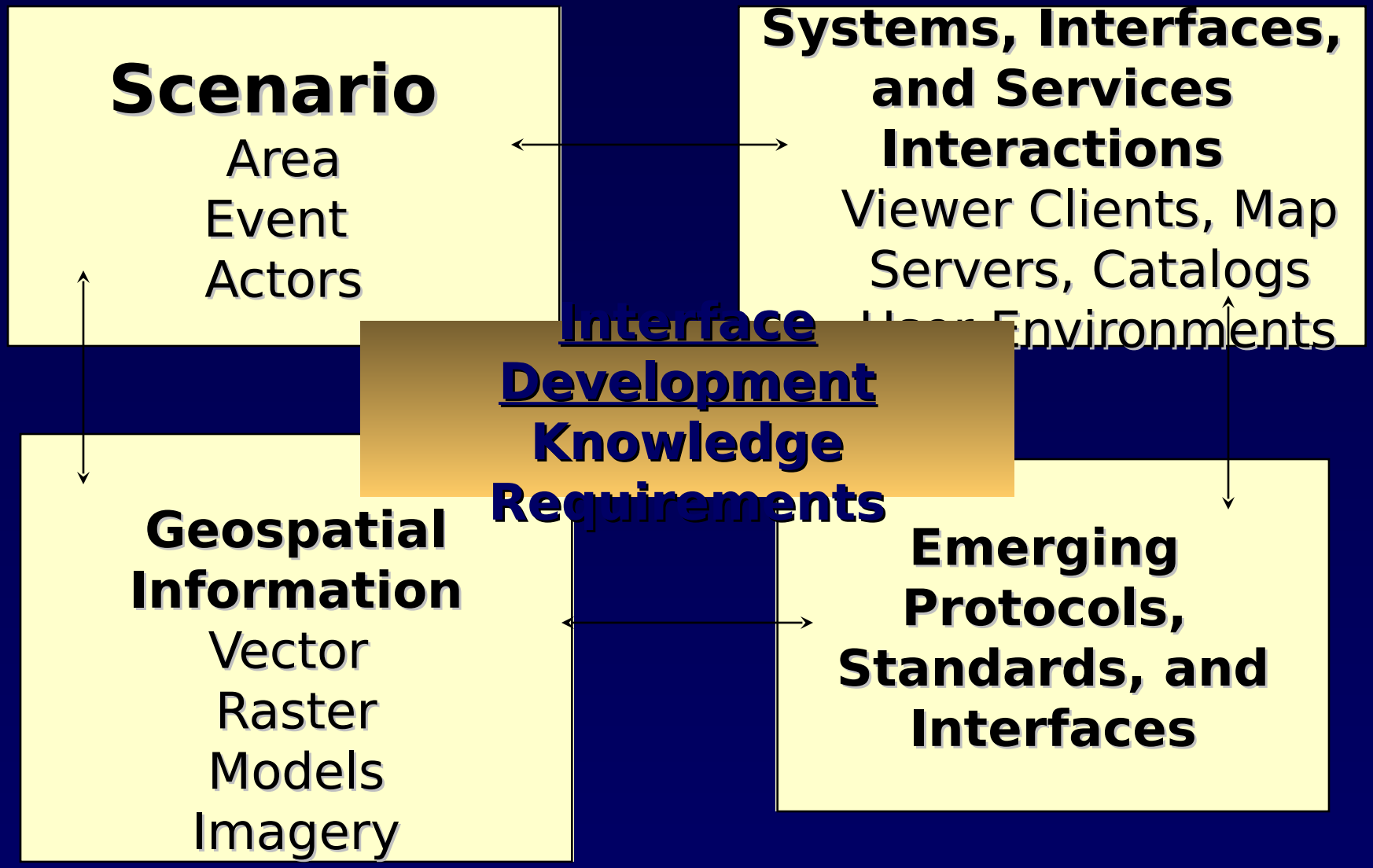
- **Fort Hood Web Mapping Pilot Project -** Web mapping for military-focused, scenario-based demonstration of discovery, spatial warehouse, distributed create/update, client interaction, terrain analysis applications, and geospatial hyperlinking. WMD scenario on CONUS site.

Potential Core Demonstration

- **Upper Lackawanna-Susquehanna, Pennsylvania, Section 206 Environmental Master Plan Project** - Baltimore District - Provide interoperable software and training to this GIS development effort to be used by local, state, and Federal officials to make better decisions regarding environmental restoration and economic development.

Technology Transfer Support

Demonstration Architecture



For Additional Information:

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